Generating synthetic SPECT images of Parkinson’s disease patients using Generative Adversarial Network

With the increasing availability of computing power, generative models are producing more realistic images than ever. Limited dataset is one of the key setbacks in applying machine learning models in image processing and image synthesis. Which is why generative models have raised interest in generating synthetic medical images. Detection of Parkinson’s disease requires extensive expert analysis of brain images in different stages of the disease. Due to being mostly reliant on human judgment, detection of Parkinson’s disease is often error prone or requires a lot of time. Whereas early detection is crucial for increased life expectancy for patients of Parkinson's Disease. Developing an algorithm to help early, and accurate detection of Parkinson’s disease requires a huge number of images in different stages of the disease. Data augmentation using rotation, flip, and scaling is not always useful for medical imaging. Because rotating or flipping might destroy the usefulness of the pattern required for diagnosis. So we propose a novel approach to use generative adversarial networks for producing synthetic brain images of Parkinson’s disease patients. Our proposed model is trained on datasets from PPMI database. We chose to train our GAN to generate synthetic SPECT images. We then train two separate NN models to detect Parkinson's disease. One of which is trained only on real data. The other is trained with both real and synthetic data. Comparison of the detection accuracy of these two separate algorithms show the effectiveness of using synthetic images.

Keywords: Generative Adversarial Networks, Parkinson’s Disease, Image Synthesis, Neural Network, Data Augmentation.

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